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Distinction between *Vicia americana* and *V. bungei* (Leguminosae)

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An East Asian *Vicia bungei* Ohwi and a North American *V. americana* Willd. are phenotypically and ecologically similar to each other. Therefore, *V. bungei* has been treated as *V. americana* var. *sinensis* Gunn. However, the former species has root tubers but the latter has not. *Vicia bungei* should be treated as a distinct species.

Key words: a discovered distinction, Leguminosae, root tuber, *Vicia americana, Vicia bungei*

Vicia bungei Ohwi has been known to be distributed in China and Korea (Ohwi 1936, Gunn 1968). It is considered to be close to *V. americana* Willd., a North American species, in phenotype and ecology (Gunn 1968). Gunn (1968) compared the two species with seven vegetative and seven reproductive characters and concluded that ovary pubescence is exclusively different between both species in spite of their disjunct distribution. In *V. bungei*, ovaries have numerous golden trichomes along the sutures and is glabrous in the valve area, but in *V. americana*, the ovary is glabrous or pubescent, if pubescent, hairs appear on both valve area and sutures, or only scattered along the sutures (Gunn 1968). Then, he treated *V. bungei* as a variety of *V. americana* Willd., i.e., var. *sinensis* Gunn (Gunn 1968).

However, variation in ovary trichomes of *V. bungei* has been reported in China variously as follows, i.e., only sutures of ovary with golden trichomes (Fu 1981, Jian 1989), hairy on adaxial suture of ovary (Jiang 1984), short trichomes sparsely distributed on ovary (Li S. 1986), or ovary without golden trichomes (Li and Ni 1985). In the last case, *V. bungei* is not distinguished from *V. americana* by the ovary pubescence. Is *V. bungei* able to be distinguished from *V. americana* by difference of ovary pubescence features?

Gunn (1968) reported that the chromosome number of *Vicia americana* was 2n = 14 (diploid). Luo and Wang (1989) reported that the number of *V. bungei* was 2n = 42 (hexaploid) from Chinese plants and they suggested that it would be better to treat *V. bungei* as a distinct species. Is somatic chromosome of *V. bungei* 2n = 42 in Korea?

Gunn (1968) described *Vicia americana* as a perennial herb. On the other hand, *V. bungei* has been described variously as an annual (Li and Ni 1985, Li S. 1986, Jian 1989, Li P. 1993, Xia 1996), an annual or biennial (Jiang 1984, Xia 1998), a biennial (Fu 1981), or a perennial (Bunge 1835, Lee 1996). Are there any habitual differences between *V. bungei* and *V. americana*?

In the present study, we aim to clarify distinctions between *Vicia americana* and *V. bungei*.

Materials and Methods

We examined the following features: 1, ovary hair of *Vicia americana* and *V. bungei*; 2, somatic chromosome numbers of *V. bungei* from a Korean plant; 3, shape of subterranean parts for recognizing life forms of *V. americana* and *V. bungei*.

Ovaries fixed with FAA were critical point dryed, and sputter-coated with platinum palladium (Pt-Pd) and observed with a Hitachi S-800 scanning electron microscope (SEM).

For observation of somatic chromosomes, after pretreatment with 0.1% colchicine solution for 2 hrs, root tips were fixed with 1:3 mixture of acetic acid and ethanol for 1–24 hrs at 10°C. Then they were macerated with 45% acetic acid for 10 mins at 60°C. After the maceration they were stained with 1% aceto-orcein for 30 mins and squashed.

Subterranean parts were observed in Korea on *V. bungei* in 1998. Also, plants cultivated from seeds of *V. bungei* obtained from Beijing Botanical Garden, Institute of Botany, Academia Sinica, People's Republic of China were used for this study.

Specimens examined are listed in an appendix.

Results and Discussion

In *V. bungei*, short-stalked glandular hairs were usually observed at the valve area of the ovary (Figs. 1–4) and unicellular, smooth walled hairs were observed on and near the sutures of the ovary (Figs. 1, 2). However, the unicellular hairs are sometimes absent (Figs. 3, 4). On ovary surface of *V. americana*, we observed only short-stalked glandular hairs (Figs. 5, 6).

The golden trichomes in *Vicia bungei* in the sense of Gunn (1968) correspond to unicellular, smooth walled hairs in our result. Presence or absence of the trichomes on ovary sutures of *V. bungei* shows a variation among the individuals within the species (Figs. 1–4). Therefore, we consider that the ovary pubescence is not available to distinguish *V. bungei* from *V. americana*.

Somatic chromosome number of *Vicia bungei* was $2n = 42$ from a Korean plant (Figs. 7–10). We consider that *V. bungei* and *V. americana* can be distinguished from each other by the chromosome number.

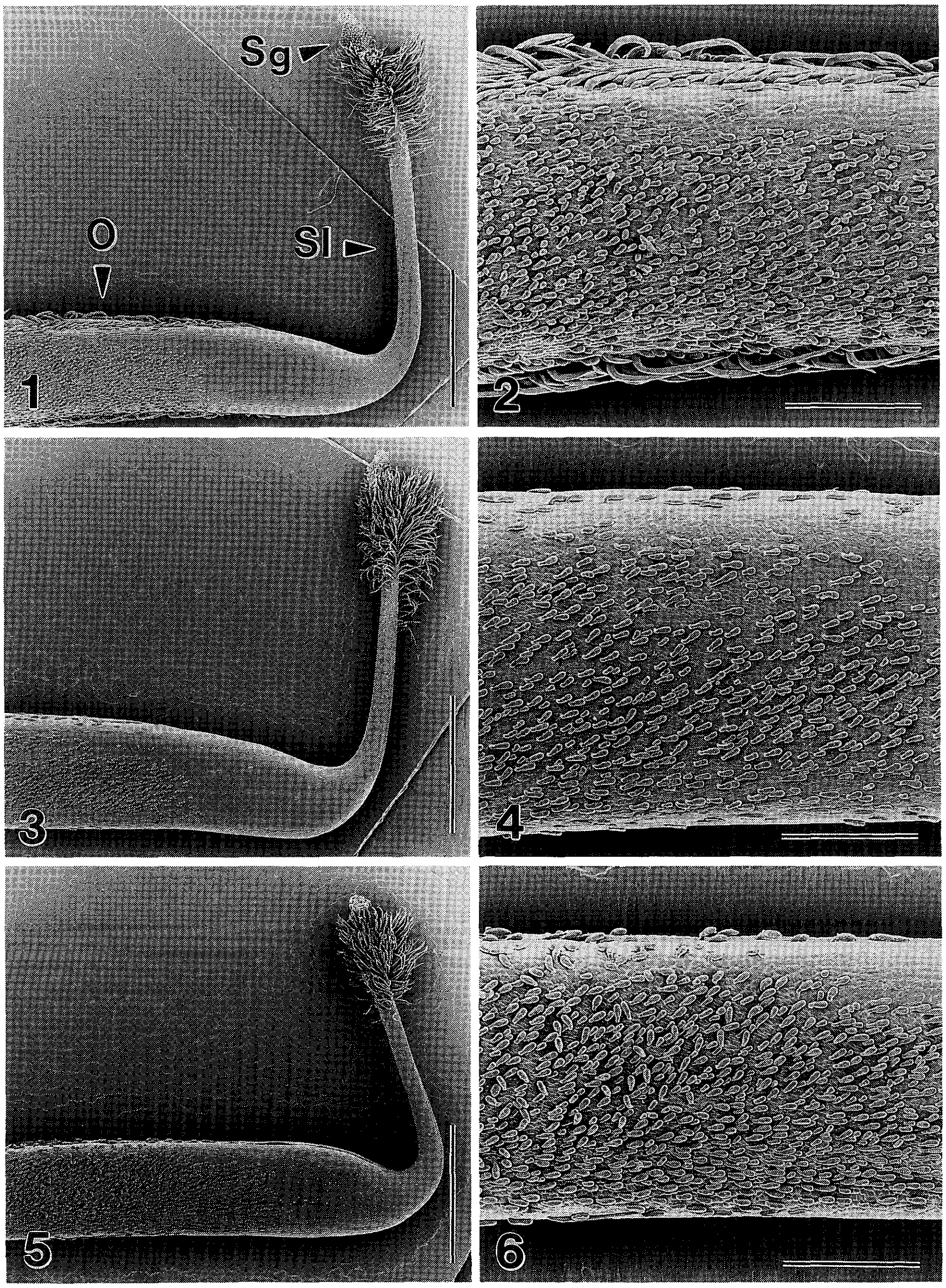
Vicia bungei in South Korea had long and slender subterranean rhizomes, the present year's stem, the previous year's stem, new lateral buds, and root tubers (Fig. 11). Maximum thickness of the root tubers reaches to 7 mm thick (Fig. 12). We observed that *V. bungei* cultivated from seeds obtained from China also have such root tubers. *Vicia bungei* is perennial and usually has root tubers. On the other hand, we could not find such root tuber of *V. americana* in any specimens or description about the species. Therefore, it is regarded that *V. americana* has not a root tuber.

Conclusion

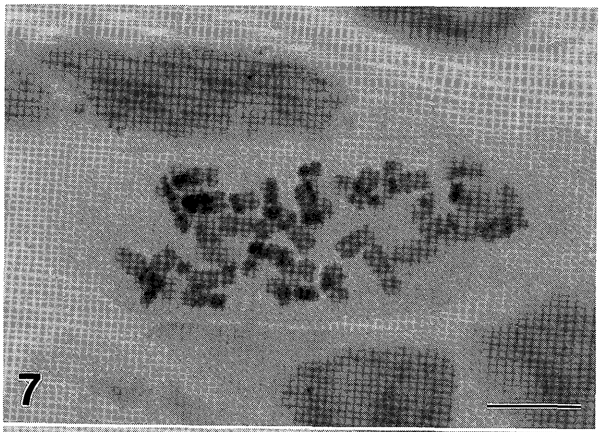
Vicia bungei is distinguished from *V. americana* not by the difference of ovary pubescence but by the differences of somatic chromosome number and presence of root tubers. Therefore, it would be better to treat *V. bungei* as a distinct species than a variety of *V. americana* as reported by Luo and Wang (1989).

Taxonomic treatment

Vicia bungei Ohwi in J. Jpn. Bot. **12**: 330 (1936); Fu, Fl. Tsilinge. **1**: 97 (1981); Jiang, Fl. Beijing rev. ed. **1**: 472 (1984); S.Li, Fl. Hebei. **1**: 770 (1986); Jian, Fl. Intramongol. 2nd ed. **3**: 373 (1989); P.Li, Vasc. Pl.



Figs. 1–6. SEM photographs of upper part of pistil (1, 3, 5) and surfaces of ovaries (2, 4, 6) of *Vicia bungei* (1–4) and *V. americana* (5, 6). Scale bars = 1.5 mm in 1, 3, 5; = 0.5 mm in 2, 4, 6. O = ovary, Sg = stigma, Sl = style. Voucher specimens: 1, 2 (B.-H. Choi and J. S. Kim on May 13, 1998, CBM); 3, 4 (S. Hang on July 15, 1995, CBM); 5, 6 (R. W. Becking on June 28, 1995, CBM).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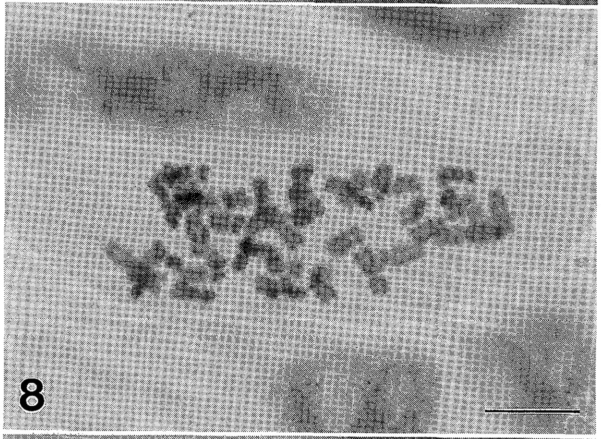
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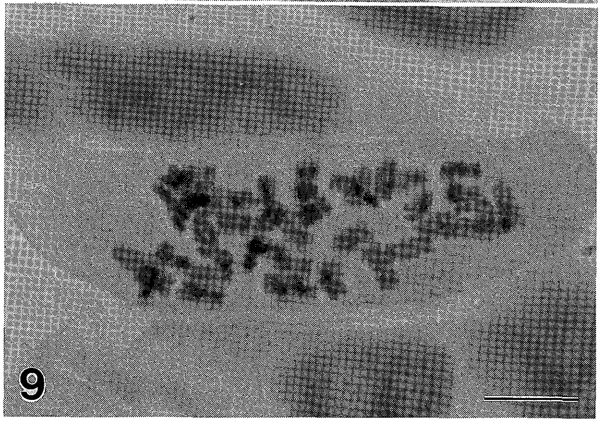
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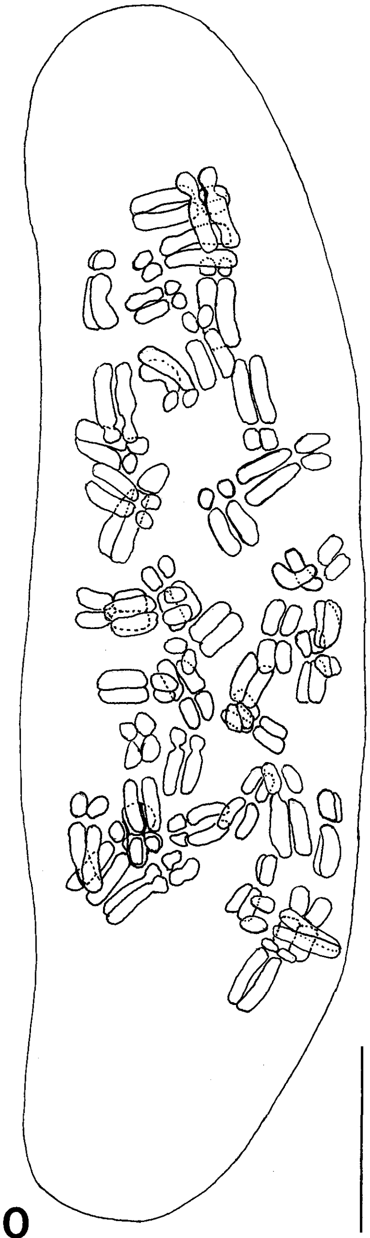
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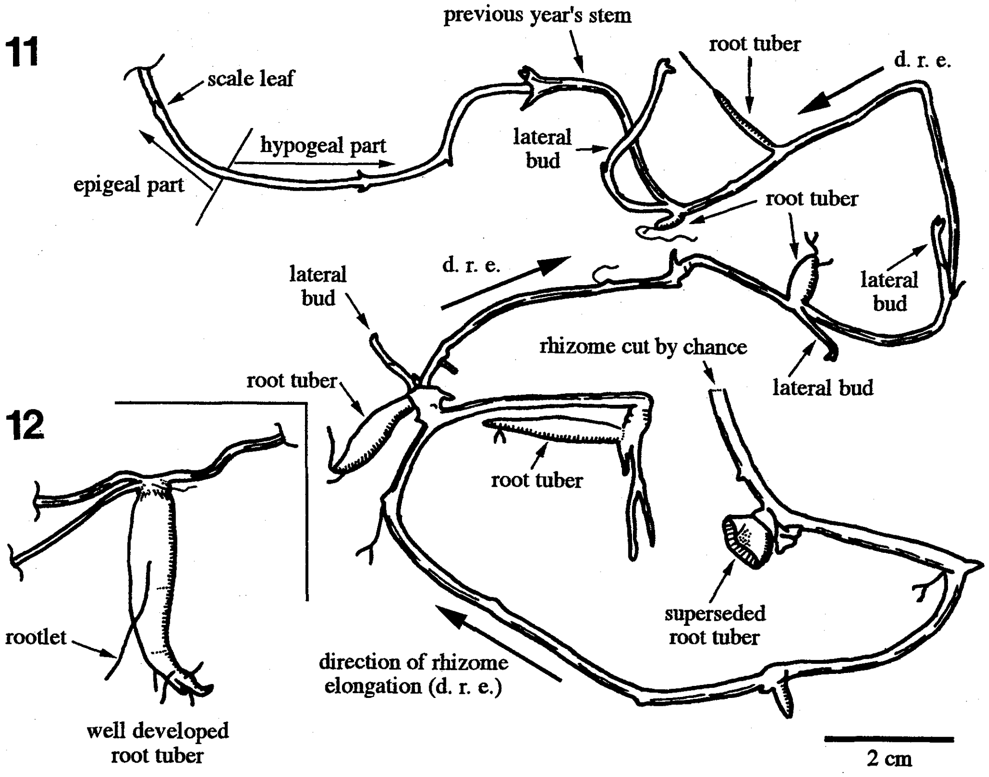
Figs. 7–10. Somatic chromosomes of *Vicia bungei* (2n = 42). 7–9. Photographs of somatic chromosomes, taken at different focuses. 10. Outlines of the chromosomes, traced from the photographs 7–9. Scale bar = 0.01 mm. Voucher specimen; B.-H. Choi and J. S. Kim on May 13, 1998 (CBM).

Hegduan Mts. **1**: 1001 (1993); Z.Xia in Acta Phytotax. Sin. **34**: 428 (1996); Lee, Lineamenta Fl. Kor. **1**: 602 (1996); Z.Xia, Fl. Reipubl. Pop. Sin. **42** (2): 263 (1998).

V. americana Willd. var. *sinensis* Gunn in Iowa State J. Sci. **42**: 211 (1968); Kupicha



Figs. 11, 12. Subterranean parts of *Vicia bungei*. 11. Long and slender rhizome with root tubers and lateral buds. 12. Well developed root tuber. Voucher specimen; B.-H. Choi and J. S. Kim on May 13, 1998 (CBM).

in Notes Roy. Bot. Gard. Edinb. **34**: 313 (erroneously cited as *V. americana* var. *tridentata*) (1976).

V. tridentata Bunge in Mem. Sav. Etr. St-Pétersb. **2**: 93 (1835), nom. illeg.; Forbes & Hemsl. in J. Linn. Soc. **23**: 185 (1887); Komar., Fl. Mansh. **2**: 616 (1904).

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Specimens examined:

Vicia bungei

(Ovary suture with unicellular and smooth walled trichomes)

CHINA: Shansi, Taiyuan; S. Omori 40 (TI): Shensi, Xi'an; K. Nakazawa in May, 1907 (TI): Hopeh, Boading; Y. Nagai 34 (TI); M. Togashi 420 (TI): Beijing; K. Ono in 1910 (TI); Y. Yabe on April 21, 1905 (TI); Y. Yabe on May 20, 1905 (TI); Y. Yabe on May 3, 1906 (TI); Y. Yabe in May, 1907 (TI): Heilongjiang, Harbin; R. Li 92 (HANU): Seeds obtained from Beijing Botanical Garden, Inst. Bot., Academia Sinica and cultivated in Japan; Y. Endo 2847 (CBM).

KOREA: Hamgyongnam-do; T. Nakai on June 11, 1909 (TI): Seoul; B. H. Choi and J. S. Kim on May

13, 1998 (CBM).

(Ovary suture without unicellular and smooth walled trichomes)

CHINA: W. Yunnan; S. Hang on July 15, 1995 (CBM): Liaoning, Shenyang; M. Nishimura on July 8, 1913 (TI).

V. americana

U.S.A.: California, Orick; Becking, R. W. on June 28, 1995 (CBM): California, Bridgeville; Becking, R. W. on June 26, 1995 (CBM).

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遠藤泰彦[a,*]，崔　秉熙[b]，大橋広好[c]：マメ科 *Vicia americana* Willd. と *V. bungei* Ohwi の新識別形質

東アジアに分布するマメ科ソラマメ属 *Vicia bungei* Ohwi は北米に分布する *V. americana* Willd. に良く似ており，識別点として分布域の違いの他は，唯一，子房上の毛のはえ方のみであるとの指摘があり，このため，*V. americana* Willd. var. *sinensis* Gunn とされた（Gunn 1968）．ところが，子房上の毛のはえ方は *V. bungei* の種内で変異し，*V. americana* で知られている毛の状態と同様な状態になる場合があり，このことから，*V. bungei* を *V. americana* から識別する形質ではないことが明らかとなった．一方，体細胞染色体数は *V. americana* では $2n = 14$ の 2 倍体（Gunn 1968）であるのに対し，V. bungei では $2n = 42$ の 6 倍体（Luo and Wang 1989）であることが報告され，さらに，本研究により，*V. bungei* では地下に肥大する塊根をつけ，これをつけない *V. americana* から識別できることが明らかとなった．以上の事実により，*V. bungei* は独立種として扱った方が良いと考えられる．

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